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ABSTRACT

The introduction of microtechnology into the educational system will generate changing demands in the environment that will affect concepts of learning and transmission and the definition of nonformal education. Challenges for educational managers in the coming decade will include (1) recognizing that the benefits of the instructional applications of computers rest with the software or programming, not the hardware; (2) recognizing a new kind of illiteracy--computer illiteracy; (3) avoiding the wholesale importation of nonindigenous instructional materials and theories in the panic to use computers; (4) being prepared for the possible structural reorganization required to accommodate a technological society; (5) admitting the insensitivity of current organizational arrangements to the accommodation of a major technological innovation; (6) deducing the type of organizational pattern concomitant with the use of computer technology and whether this pattern is locally relevant or applicable; (7) readjusting concerns from equal opportunity to equal outcome and avoiding exacerbation of existing social, political, and economic polarization; and (8) being aware of the hidden, ongoing personnel costs of effectively introducing computers. Twenty-three references and notes are given. (LMM)

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# "Computer Technology in Education: Redefining the Modes of Educational Transmission"

A Keynote Address
to the
Fifth Regional Conference of
Commonwealth Council for
Educational Administration

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## INTRODUCTION

The main theme of the Fifth Regional Conference of the Commonwealth Council for Educational Administration in education of the future. In many ways being asked to speak to the future is easy. It will be many years before anyone can truly prove you wrong. On the other hand, speaking to the future implies that you are not necessarily addressing issues of immediate salience and consequently open to charges of irrelevancy. I will take a chance on the latter, since I have chosen what at first glance will be an irrelevant topic to an audience comprised mostly of third world educators.

However, to identify what might be the most important concern of educators in the coming decade, is not difficult. It is becoming increasingly evident that the educational oracles of the coming decade will focus their attention on issues related to technology, micro technology, and computers in the education system.

Computer Technology in Education

In many ways a concern for the impact of technology in education is not new, and in a general sense, neither are concerns for the impact of computers. However, the recent advances in computer technology have placed these concerns in a different context. The tubes of the 50's and the transistors of the sixties have become the microchips of the 70's and 80's. A 'chip' half the size of a fingernail can do the job of 100,000 transistors. The 'micro revolution' as it is often called, has some implications for educators throughout the world.

Firstly, there is no longer much debate regarding the inevitability of computers in schools. What some people once referred to as just another educational bandwagon has turned into a high speed locomotive. Today's discussions centre, not around issues of whether computers should be in schools, but around how they should get there and how they should be used. Estimates are for instance, that by 1985, as high as 75 percent of schools in the United States will use some form of computer assisted instruction.[1]

Secondly, it is only natural that as industrialized nations move rapidly towards a computerized society and computerized schools, less developed nations will begin to feel some panic at being left behind. Indeed, in an educational sense, if the computer lives up to only a fraction of its espoused potential, then regions that do not utilize computers will be left behind, widening the developed-developing, first world - third world, north-south gap.

However, the issues in the utilization of computers in schools in either developed or developing areas are not as simple as

accepting both the inevitability of an increased computerized society and the concomitant need for computer utilization in schools. More important than issues and questions directly related to the technology itself, is the fact that the spreading of the technology will encourage, if not force, a re-examination of some fundamental issues in education. The consideration of 'adult, non-formal and continuing education' provided the parameters for an examination of these issues.

## Defining the Modes of Educational Transmission

Adult, non-formal and continuing education, are three areas that do not necessarily refer to the same form of education. Non-formal could be a subset of adult, as adult could be a subset of non-formal --- and so on.

Unfortunately 15 years of polemics and debate in the areas of adult, non-formal, formal, informal, etc., has still not resulted in any clear ways of defining these three modes. There are, however, three defining characteristics from which definitions can be made: (i) the type of learning and instruction involved (ii) the organization of the instruction and learning and (iii) the purpose or intent of the instructional process.[2]

In the balance of this paper, these three defining characteristics are examined in the context of a future technological decade. Consequently, an appropriate title for my address might be: Computer Technology In Education: Redefining the Modes of Educational Transmission."

Special attention will be given to management challenges concomitant with the introduction of computers into third world schools.

## COMPUTERS IN EDUCATION: THE TYPE OF LEARNING AND INSTRUCTION

On way of defining non-formal education and the other modes of educational transmission is the type of learning and instruction

involved. Traditionally, the modes were defined such that the focus of formal education was upon knowledge, informal upon attitude and non-formal upon skill generation. This is not to suggest that non-formal modes are concerned only with skill generation, but that the stress or focus was upon skills, and delivery mechanisms in non-formal education have reflected this focus. Recent, more integrated concepts of non-formal education have linked the concepts of learning to such concepts as socialization, conditioning, communication and enculturation.[3] In turn, the concepts of learning and transmission have adjusted themselves according to changing demands in the environment.

How, then, will the introduction of micro technology into the educational system generate changing demands in the environment, and how will these changing demands affect concepts of learning and transmission? How will they affect the distinguishing definition of non-formal education? What will be the challenges for educational managers in the coming decade?

## Theories of Learning and Instruction

Educators have been seeking the answers to how learning takes place for perhaps 3000 years and unfortunately we are not much closer to the definitive answer than Socrates was. At issue with regard to the micro technology of the coming decade is the fact that the introduction of computer technology into the learning process may put the answer to rest and define this first component of the non-formal education definition. The definition of 'thinking', for example, may be made by the introduction of 5th generation 'thinking' computers.

When identifying the benefits of educational computing, one is identifying the benefits of the software of the instructional programming and educational computing software represents, to a large degree, a particular perspective on how learning takes place. Despite LOGO and other visisions of the extensions of the human mind,[4] the instructional use of computers represents what is known as the instructional design/instructional technology approach to learning.

My intention is not to refute this view of learning, only to suggest that the assumption about learning inherent in most instructional application of computers represents a narrow portion of hypothesized learning theories. You can not accept the instructional use of the technology without accepting the theory of learning upon which the instructional applications are based.

This suggests the first challenge for educational managers of the coming decade.

*CHALLENGE #1. Recognize that the benefits of the instructional applications of computers rest with the software or programming, not the hardware.*

It should be pointed out, of course, that these benefits may be significant. Many benefits of the instructional use of computers have been observationally, if not objectively, identified. First, if drill and practice is part of an instructional pattern, then the computer can remove much of the 'drudgery' from the teaching day. Secondly, in most instructional applications, the computer is only a tool of individualized instruction. The potential benefits of the increased use of computers are, therefore, related to the impressive list of potential benefits accrued in an individualized instructional setting.

Despite the 'Hawthorne' effect, one of the most significant of these benefits is increased student (and teacher?) motivation. Thirdly, computerized instruction has been found to be particularly effective with disadvantaged students.[5]

Furthermore, the benefits of learning 'about' computers are difficult to refute for any setting today. Regarding computer literacy, several authors have correctly pointed out that ignorance of computers will eventually render people as functionally illiterate as ignorance of reading, writing and arithmetic does today.[6] Similarly, regarding computer science courses, it is difficult to argue the potential benefit of training local personnel to install, repair and maintain present and future computer installations. This training focus has, in fact, been suggested as an appropriate concern for priority attention in developing areas, and suggests a second management challenge.[7]

*Challenge #2. All educational managers, especially those involved in non-formal education, should recognize the existence of a new kind of illiteracy -- computer illiteracy.*

However, this discussion of learning theories and the computer suggests some further, more cautionary, implications and challenges.

Firstly, many educational leaders have been concentrating for decades upon the development of indigenous instructional materials. In Canada a decade ago there was a large hue and cry from concerned educators regarding the purchasing of American textbooks for our schools. It is paradoxical to see these same educators tripping over each other to buy American computer based instructional software.

This issue should be of special concern to educators in the third world. If it can be argued that the instructional design/instructional technology approach has its origin in western industrialized nations, then it is salient for third world educators considering introducing computers into their educational systems to ask whether this particular approach to learning is compatible with approaches to learning indigenous to their particular culture or third world nation.

In this regard a number of authors argue that the instructional design and instructional technology approaches to the design of learning experiences are particularly unsuitable for transfer out of western industrialized societies.[8 & 9] Furthermore, we do know that there is evidence against the cross cultural validity of other western learning theories.[10]

Consequently, of specific concern to third world educators should be the surfacing of a new form of dependency upon the industrialized world. This is an intellectual and value dependency that might occur with the importing of non-indigenous instructional software. In the computer area, the temptation will be very strong to import prepackaged software and the concomitant approach to learning. The abandonment of traditional models of instruction for the sake of fast procurement of instructional packages from developed areas, clearly represents the kind of dependency that many authors are warning against.[11]

This suggests a challenge for educators all over the world.

*Challenge #3. In the panic to use computers in an instructional setting educational managers must avoid the wholesale importation of non-indigenous learning materials and theories.*

Finally, with special reference to non-formal education, it can be seen that the computer provides a vehicle for the

de-institutionalizing of a very broad spectrum of learning areas. Individualized instruction has been touted for some time as the instructional mode most suited to the adult/non-formal learner. The computer will enhance the potential for individualized learning, but bring with it special constraints on the learning process itself.

*Challenge #4. Computer technology will be particularly attractive to the adult/non-formal educator concerned with such issues as distance learning, individualized learning, etc. These managers must understand the theories of learning that accompany the technology.*

The introduction of computer technology into education systems of the world has the potential of rendering somewhat meaningless the use of knowledge, skills and attitudes as one of the traditional distinguishing characteristics of formal, non-formal and informal education.

## COMPUTERS: THE ORGANIZATION OF EDUCATION

A second distinguishing definition of the modes of educational transmission is the varied deployment of the elements of time, space, material and people; the organization of educational resources. The distinctions here have probably been traditionally one of the clearest distinctions between formal and non-formal on the one hand and non-formal and informal on the other. Generally, non-formal, like formal, has been defined as deliberate and systematic instruction. This separates it from informal where the intent is incidential not deliberate. Non-formal has been distinguished from formal, however, by its location outside of the organizational technology of formal education. Non-formal education is characterized by more diverse and

flexible deployments of space, time, material and personnel. How then might the possible introduction of computers into the educational system alter this important distinguishing characteristic?

There are three particularly salient observations regarding the organization of schooling and computer technology. Each suggests a different challenge to the educational manager of the coming decade.

Firstly, the instructional use of computers in schools will suggest some drastic changes in such areas as the curriculum, employee-employer relations, student control and grading. How, for instance, do we evaluate a teacher whose instructional program is mostly handled by a computer? Or, if the computer is to be the main mode of communication, should we not teach typing as a compulsory primary school subject and leave writing to a grade 10 option. The point is not to debate these issues, but rather to point out that extensive instructional use of computers may require some extensive organizational restructuring.

But I think all of this is most obvious, and the challenge is particularly clear and often stated.

*Challenge #5. Are educational managers of the coming decade prepared for the possible structural reorganization required to accommodate a technological society?*

We could leave the organizational issue with a resounding "yes" to this challenge. We are, after all, rational people, rational scholars and administrators and we all recognize the need to adjust organizational arrangements to instructional innovations.

But I do not think it is that simple. In fact I think that the pressures of instructional technology are going to result in the exposure of something that up to at this point only a few scholars in educational administration have obfusely debated in graduate classes.

Let me illustrate with quotes from some recent authors on the subject of school organization.[12]

> The main function of the school principal seems to be one of organizational maintenance, particularly insuring the smooth operation of school routines.
>
> Martin, 1980; Morris, 1981.

> ..... Adaptive or innovation behavior in public schools is more likely to be undertaken to ensure bureaucractic or social stability then for improving efficiency in goal attainment.
>
> Pincas; 1974.

> Organizational leaders tend to be preoccupied with maintaining their oganization (whether society "needs" them or not) as a means of protecting their own self interest.
>
> Wilson, 1973.

> ..... Human service organizations have more important things to do...then to meet their announced goals... failure to provide unofficial benefits will be keenly resisted, but failure to achieve official goals will not...
>
> Perrow, 1978.

> The current procedures for resource allocation at the building level have more to do with equatability of adult working conditions than with the production of responsive learning environments for children.
>
> Mann, 1981.

> Educational goals, if achieved at all, are attained almost by accident, with little help from the administrative structure or, indeed, in spite of organizational arrangements.
>
> Boyd & Crowson, 1981, 319.

I could continue with many more, quoting most of the prominent organizational theorists. Those of you who follow the arguments in this field recognize such descriptors as Weick's (1976) 'loose coupling'[13] and Cohen and March's (1974) 'organized anarchy'[14] in the substance of the quotations I have read.

Quite simply stated, and this is the second observation, researchers are beginning to examine what it is that school administrators actually do and have discovered that there is not a very good fit between organizational arrangements and instructional intent. Why for instance, are school organizational patterns not concomitant with some commonly accepted concepts like mastery learning?[15]

My point in raising the issue here is that perhaps until pressured by an educational innovation that has societal sources - like computer technology - both theorists and practioners can be quite resistance to change. There are, of course, some very rational reasons for this resistance to establisning a stronger organizational instructional link. But the next decade may introduce what is probably the most significant instructional innovation in hundreds of years and this innovation may require unique organizational arrangements to be successful. The challenge to educational managers may be as follows.

*Challenge #6. Can you admit the insensitivity of your organizational arrangements to instructional intent, and either in theory or in practice accommodate a major technological innovation?*

A third observation is that specific reference to the educational manager in developing areas complicates the issue of the computer technology-instruction-organization triangle even more. The following observations and consequent challenges are drawn from the literature representing

twenty years or so of work in the area of development administration and more recently work in the area of organizational functioning across cultures.

First is the observation that the administrative structure in many developing areas, perhaps as a result of colonial legacy, may be even less malleable than those in developed area. I heard a visitor to a commonwealth developing area comment once that "the schools were more British than the British." The implication is, of course, that school structures maybe even less receptive to the required organizational changes concomitant with computer technology in the educational system.

Second, however, is the issue of whether or not they should be receptive to this organizational pattern. As suggested earlier, it is quite clear that the technology and the consequent instructional forms were developed in western/industrialized contexts. Similarly, the accompanying organizational patterns have a western or industrialized nation source. Many authors today are pointing out, as a result of research not speculation, that organizational practices indigenous to one culture should not be transferred to another.[16] Some researchers have suggested that one of the by products of the past 'forced transfer' of Western or European administrative practices is 'formalism' or an increased surface subscription to formal rules and regulations while underneath the surface the real mechanisms of indigenous organizational forms are in operation.[17] The point, however, is that as existing school organizational patterns in many developing areas are not indigenous, neither will be the organizational patterns imposed by computerized instructional systems.

*Challenge #7. Can you deduce the type of organizational pattern concomitant with the use of computer technology in your education system and is this pattern or structure locally relevant or applicable?*

It remains, however, to suggest an answer regarding the distinguishing definition of non-formal education. If we remain with the traditional definition of non-formal education being those 'de-institutionalized' or 'outside of school' activities, then one scenario is that the introduction of computer technology will make all of education non-formal.

A corollary to this, however, is the scenario that the extensive use of instructional computers in non-formal education may remove the 'flexible' variable in the deployment of space, time, material and personnel. The technology may dictate the deployment.

Whichever scenario occurs, it is possible that the organizational implications of the introduction of computer technology in education will render meaningless this particular distinguishing definition between modes of education transmission.

## COMPUTERS IN EDUCATION: THE PURPOSE AND INTENT OF EDUCATION

A third distinguishing definition of modes of educational transmission is the purpose or intent of the act. With regard to non-formal education specifically, the purposes and intents have been couched in such terms as human development and equality. Non-formal education has, in many ways been a response to the growing limitations of formal education in promoting, firstly the traditional concepts of economic development and secondly the more recent concepts of human development. Much research in both developed

and developing areas over the past two decades has pointed out that the quantitative expansion of educational opportunities has not held the key to national development and progress.[18] In addition, similar research has been making it painfully clear that if educational productivity is our concern, then increasing the traditional inputs into formal education is not the answer.[19]

Consequently many educators are redefining the concept of 'effective education' in the context of altered concepts of the desired development process. It is, of course, in the context of this redefining of education that non-formal education and related concerns for adult, continuing education, etc. have surfaced as unique components of the educational delivery system.

To illustrate, and to establish some context within which to examine the technological issue, we might refer to the PATNA Declaration on Adult Education in India where statements are made to the effect that adult education is seen as a "movement to bring about social change and equality."[20] It appears that although all forms of education have been promoted as instruments of equality and social change, it has become a defining distinction that non-formal education take as a special goal the pursuit of equality and social change. Therefore, the focus of my remarks here is upon the impact of computer technology for the pursuits of equality and social change.

## Equality and the Disbursement of Educational Dollars

The issue of equality has been a priority concern of educators all over the world for decades. Over the years the concerns have undergone a metamorphosis from concerns for equal opportunity to concerns for equal outcome. In essence the arguments have been

that provision of equal opportunity for education made little sense since firstly, not everyone made equal use of this opportunity and secondly, equal use did not result in what we might call a more equitable existence in life. Consequently there has been some disillusionment with education and we have not seen much evidence that the poor (and I am using this term in the broadest sense to refer perhaps to the lowest quartile in socio economic terms in any country) have benefitted significantly from increased expenditures in education. Without any doubt one of the major policy issues facing education planners in the coming decade is a re-consideration of distribution of education dollars in light of the concerns for equal outcomes. My intent here is not to delve into this issue in any considerable detail, but to point out how the use of computers in schools has the potential to both engender a new, perhaps more equitable social order, as well as the potential to considerably exacerbate existing social, political and economic polarization, Which of these scenarios will result will depend totally upon implementation strategies.

For instance, in the computer literacy and computer science areas, program implementation strategies should give priority to schools in 'disadvantaged' areas where students are not likely to become computer literate through their normal home or social activities. Estimates about the number of home computers that will be sold in the coming decade suggest that students from families that either cannot afford to buy computers or do not give any priority to the instructional applications may be left behind. Recent evidence from the United States is indicating that the educational system may compound this situation as the more wealthy school districts are proceeding with computer implementation in schools much faster than are poorer school districts.

The situation is, of course, exacerbated in the third world context. Assuming of course that the 'computer literate' are those that benefit from the increasing use of computer technology in society, and since the rich-poor gap is considerably wider in lesser developed areas, there is increased danger of the misplaced application of computers into the school system functionally widening the gap between the rich and the poor.

Misplaced is, however, the important qualifier, since it is conceivable that concerted efforts by educators to resist the inevitable political pressures to put computers into ' elite' schools could promote the image of the computer as the great equalizer. For example, as some computer ocacles propose, the computer can offer anyone a 'window' into the world of knowledge and if knowledge is freedom then some unique use of computers in third world education could be concomitant with contemporary prespectives on international development. Consequently the challenge for education managers of the coming decade is as follows.

*Challenge #8. Readjust your concerns from equal opportunity to equal outcome and ensure that if computers are introduced into the school system, they are introduced in such a way as not to exacerbate existing social, political and economic polarization.*

There is a further issue, however, that could impinge significantly on the equality issue and that issue is the redeployment of education dollars into the educational applications of computers. To do so is to make a decision to embark on a very expensive educational experiment. Micro computers have drastically decreased the hardware cost, but software costs are very expensive,

directly proportional to the cost of skilled instructional design labor, and are increasing as fast as the technology costs are decreasing. The key word here is 'skilled' since one of the few things we do know about educational computing is that it takes a specially trained educator to design the instructional program for use in computers. In addition, the successful implementation of any educational innovation is highly dependent on a well trained or inserviced teacher population.[21]

These observations suggest on additional challenge to the educational manager of the coming decade.

*Challenge #9. You must be aware of the hidden and ongoing personnel costs of effectively introducing computers into your educational system. Is the direction of the implementation addressing or exacerbating equality and consequently worthy of scarce resource deployment?*

The area of finance holds a special challenge for educators in developing areas. I read an article recently where an African educator observed how his nation would like to bring computers into their schools and then he implored aid agencies to help his country buy computers.[22] Educational managers in developing areas should keep in mind that the 'upfront' costs of purchasing micro computers hardware are quite small compared to continuing personnel and software costs.

While school systems in developed areas can afford to support the micro computer experiment, school systems in developing areas, with annual recurrent expenditures that are probably 5% of those typical to North America, may not be able to afford the expense. The operational expenditure per student per year in a typical African country would purchase perhaps three blank floppy disks used for the storage of instructional programs.

In addition, with possibly 50% or more of their teaching population having no training at all, many developing areas have a considerable way to go before inservice in the instructional application of computers makes sense. Furthermore, without local personnel skilled in this area, third world nations will be highly dependent upon imported experts and imported instructional software. This suggests an additional challenge for education managers in the third world.

*Challenge #10. Question claims that the introduction of computers into third world education will help develop nations "leap frog" into equality with the developed world.*

Finally in the context of non-formal education the implications and challenges for education managers are quite clear. The instructional use of computer technology offers you the opportunity to amplify the distinguishing definition of purpose: social change and equality. Unfortunately, improper implementation will result in social change of some sort, but will promote inequality, not equality.

With reference to education of the future, it is my view that issues related to micro technology and computers in tne educational system will be of come importance over the next decade. No nation, including the poorest of the developing nations (perhaps especially the L.L.D.C.'s) will be immune from the effects of the 'microchip' revolution.

Regarding 'adult, non-formal and continuing' I have suggested that the traditional distinguishing definitions of non-formal education may be rendered meaningless by computer technology in the educational system. The de-schoolers may simply have been a little premature in their prediction of the demise of the formal educational system, a demise that might now be engendered by microtechnology. Paulo Friere and a micro computer make strange bedfellows.

Regarding management challenges, the challenges become ones of proacting and redefining. Proactive leadership will require an understanding of both the promises and the pitfalls of computer technology in society and in the educational system. Redefining will require firstly an understanding of the possible effects of the technology in distinguishing between the traditional modes of educational transmission and secondly an understanding of the relationship between the modes of educational transmission and the type of national development desired. The Patna declaration stated it very well with reference to adult education.[23]

> There is a need for defining adult education both relevantly and radically...the philosophical and process levels has to involve itself deeply in the development process of the country....

I hope the issues I have raised regarding computer technology will help ensure that it is you who do the re-defining and not the technology.

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